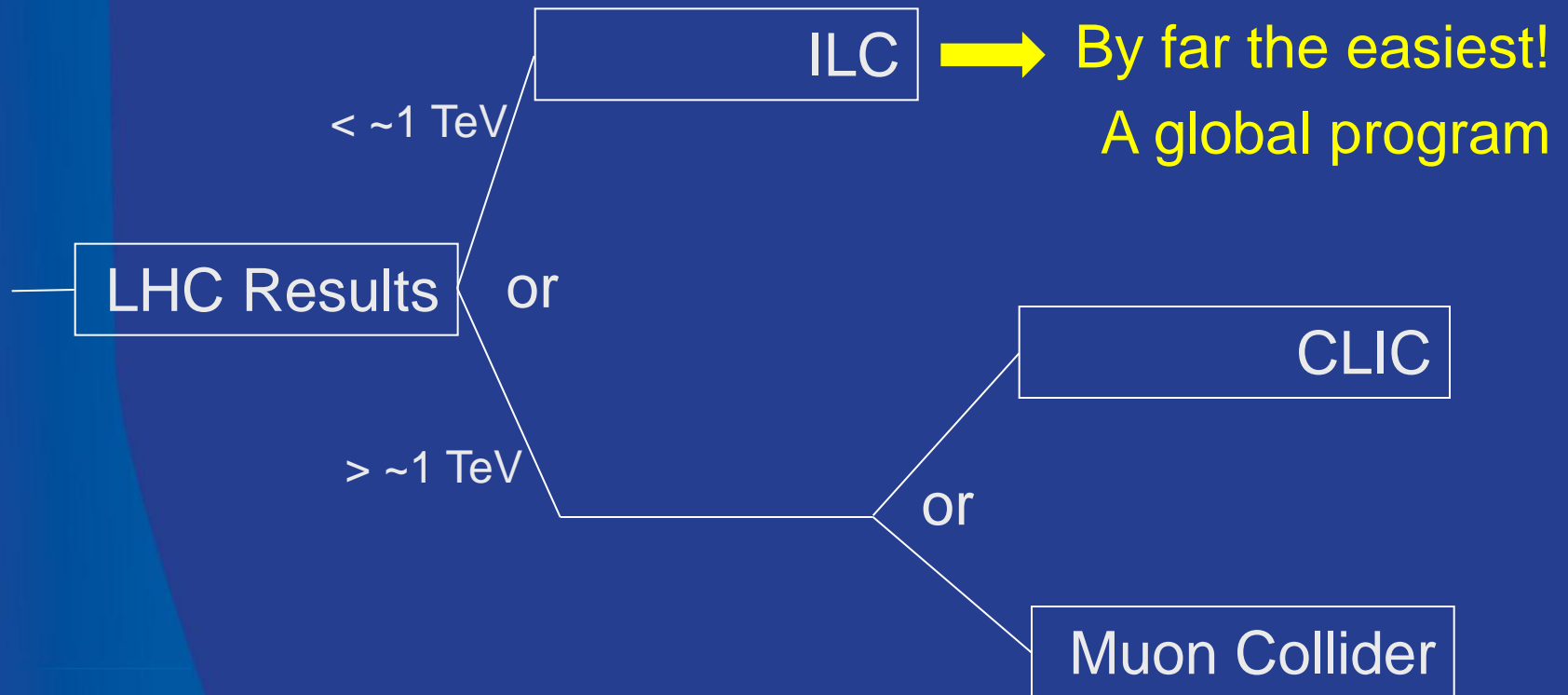


# *WELCOME*

*Young-Kee Kim  
Muon Collider 2011  
Telluride, June 27, 2011*

# Future Colliders at the Energy Frontier

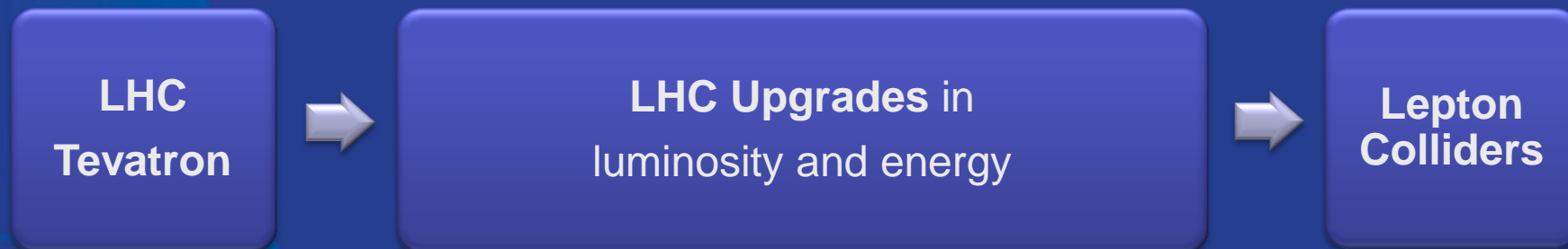


# Fermilab Energy / Intensity Frontier Strategy (aligned with P5)

To build upon our existing strengths to establish a world-leading program at the Intensity Frontier, enabled by a world-class facility



...and use this program to provide a cornerstone for an Energy Frontier facility beyond LHC



Technology Development on Detector and Computing

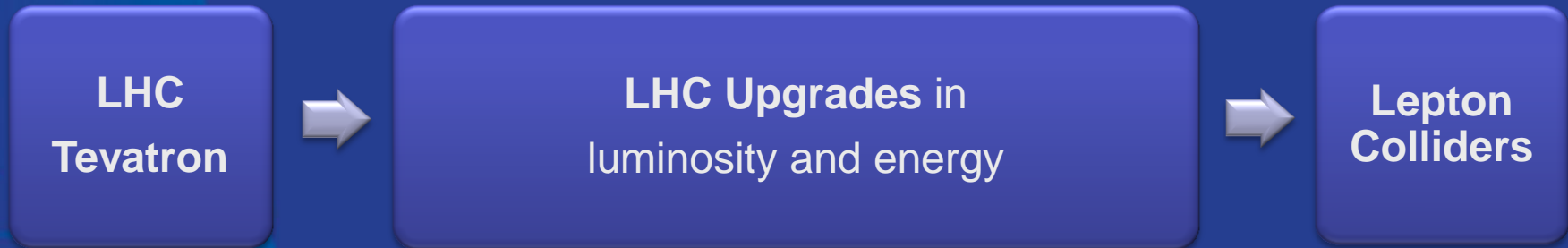
...while relying on a strong program of technology development on detector and computing.

# Fermilab Energy / Intensity Frontier Strategy (aligned with P5)

To build upon our existing strengths to establish a world-leading program at the Intensity Frontier, enabled by a world-class facility



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Technology Development and Fundamental Accelerator Science

...while relying on a strong program of technology development and fundamental accelerator science.

# Fermilab Energy / Intensity Frontier Strategy (aligned with P5)

To build upon our existing strengths to establish a world-leading program at the Intensity Frontier, enabled by a world-class facility



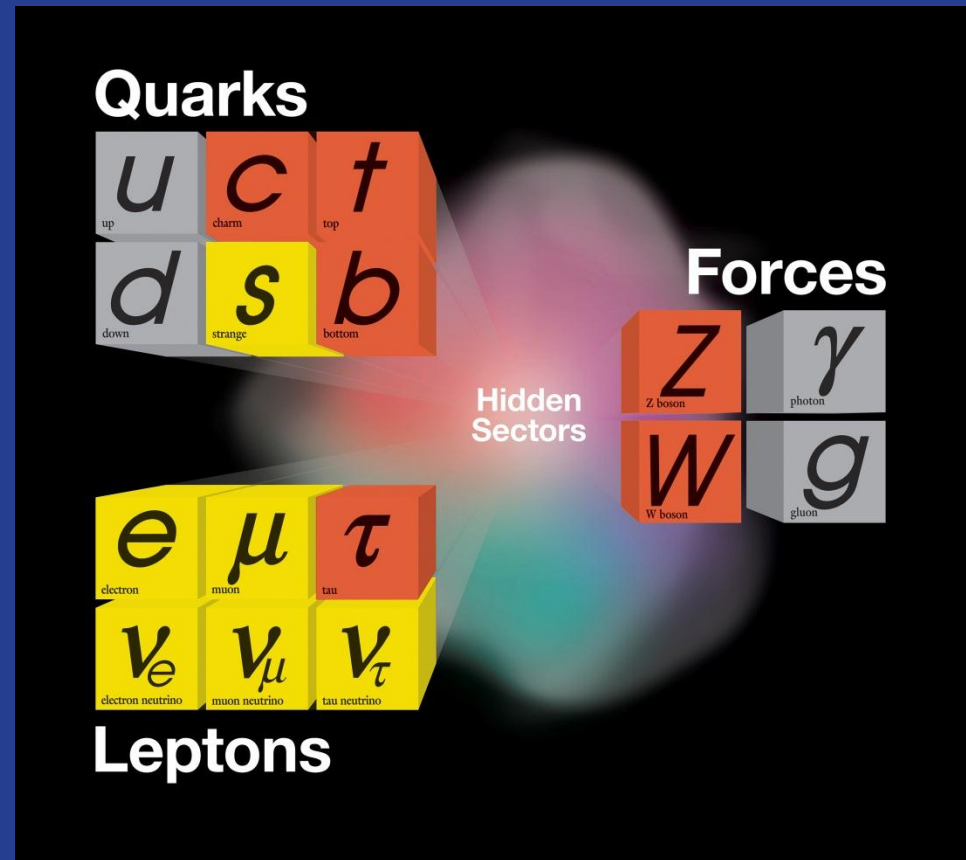
...and use this program to provide a cornerstone for an Energy Frontier facility beyond LHC

Technology Development and Fundamental Accelerator Science

...while relying on a strong program of technology development and fundamental accelerator science.

# The International Context

- Leadership for the US in neutrinos & rare processes, where major improvements are possible with *Project X*
- US activities via international collaborations in other regions



# Project X and the big questions

Where does mass come from?

Why is matter dominant?

What are the neutrino masses and what do they say?

Where are the heavy neutrino partners?

Why are there three families of quarks and leptons?

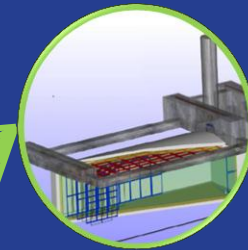
Do the forces unify?

Does nature use supersymmetry or other new symmetries?

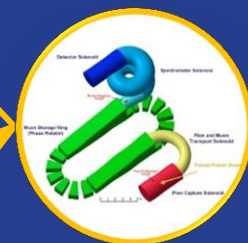
Are there extra dimensions of space?

What is dark matter?

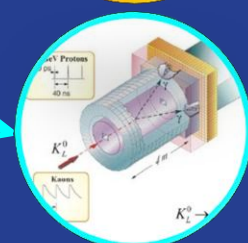
What is dark energy?



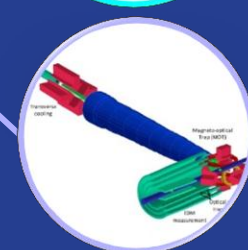
neutrinos



muons



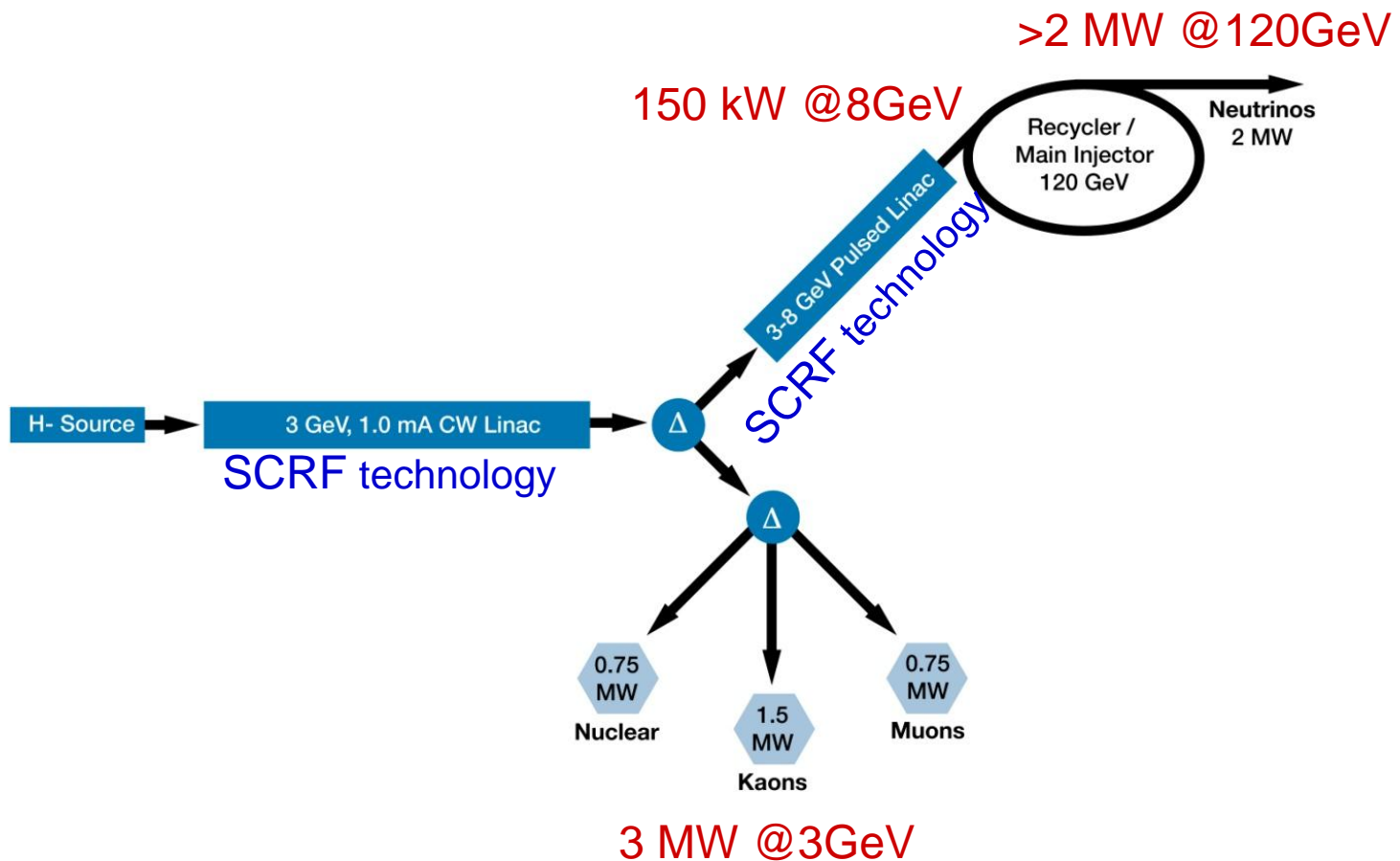
kaons



Nuclei  
(EDMs..)

# Accelerators next decade: *Project X*

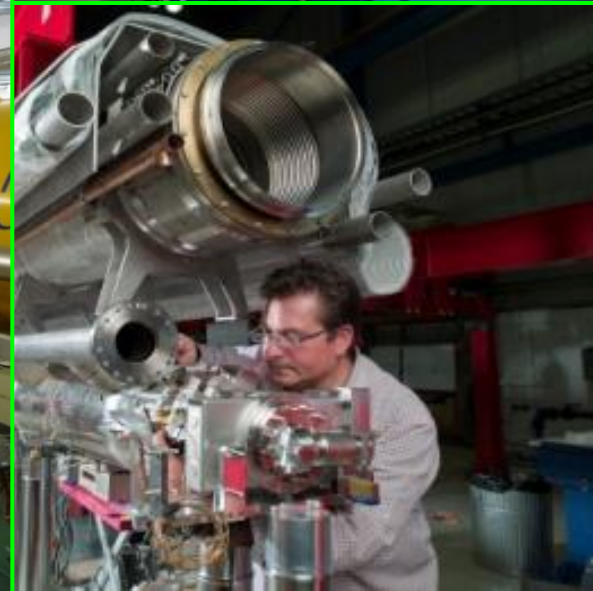
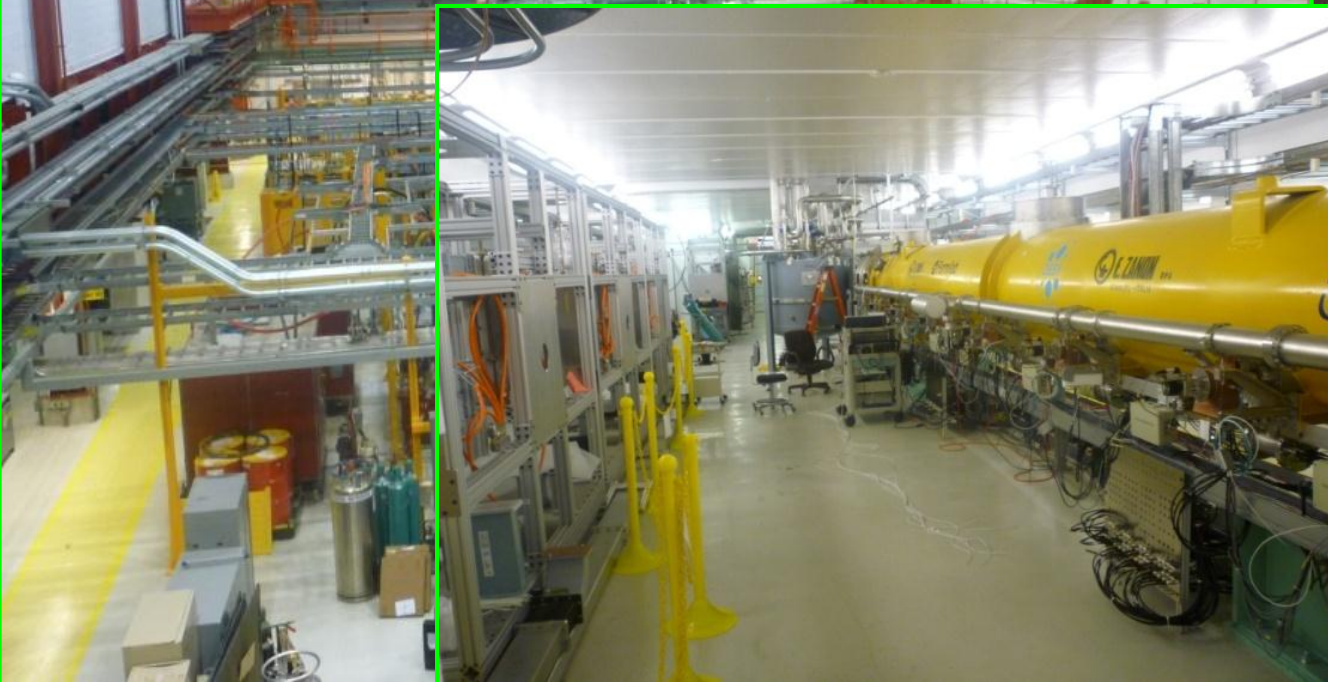
## Reference Design





# Project X and ILC

- Superconducting RF Technology
- Project X Collaboration MOU with ILC/ART

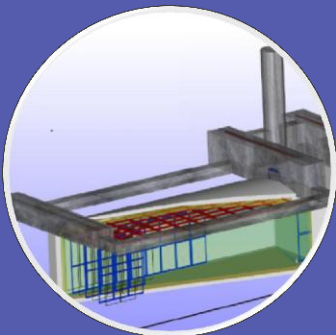


# *Project X: Accelerator Collaboration*

- A multi-institutional collaboration has been established to execute the Project X RD&D Program.
  - Collaboration MOUs for the RD&D phase. Signatories:
    - ANL, BNL, Cornell, Fermilab, JLab, LBNL, MSU, ORNL/SNS, SLAC
    - ILC/ART
    - India: BARC/Mumbai, IUAC/Delhi, RRCAT/Indore, VECC/Kolkata
  - Other collaborators
    - CERN, UK, China
- Applications beyond Particle Physics
  - Rare isotope production for nuclear physics
  - Neutron sources
  - Accelerator-driven energy systems
  - X-ray FELs
  - Energy recovery linac
  - Muon facilities for materials research



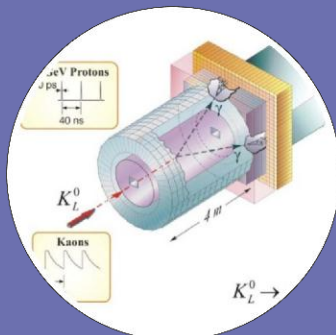
# Project X: experiments



Stan Wojcicki (Stanford)  
Gina Rameika (Fermilab)

## Neutrinos

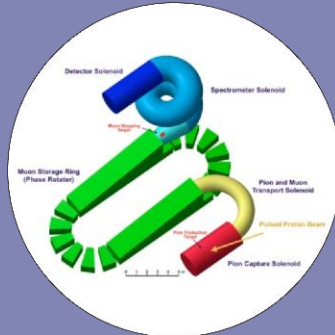
- Matter-antimatter asymmetry
- Neutrino mass spectrum
- Neutrino-antineutrino differences
- Anomalous interactions
- Proton decay
- SuperNova bursts



Doug Bryman (UBC)  
Bob Tschirhart (Fermilab)

## Kaons

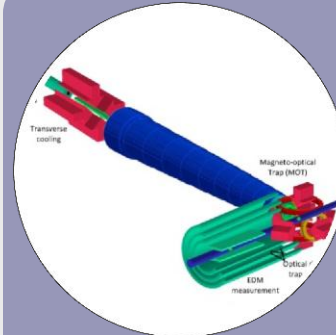
- Physics beyond the Standard Model
- Minimally flavor violating supersymmetry
- Elucidation of LHC discoveries
- Two to three orders of magnitude increase in sensitivity



Yoshi Kuno (Osaka)  
Jim Miller (Boston)

## Muons

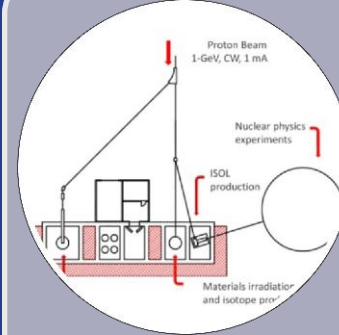
- Oscillation in charged leptons
- Physics beyond the Standard Model
- Elucidation of LHC physics
- Sensitive to energy/mass scales three orders of magnitude beyond LHC



Jerry Nolen (Argonne)  
Guy Savard (Argonne)

## Nuclei

- New generation of symmetry-test experiments
- Electric Dipole Moments
- Three or more orders of magnitude increase in Francium, Radium, Actinium isotopes

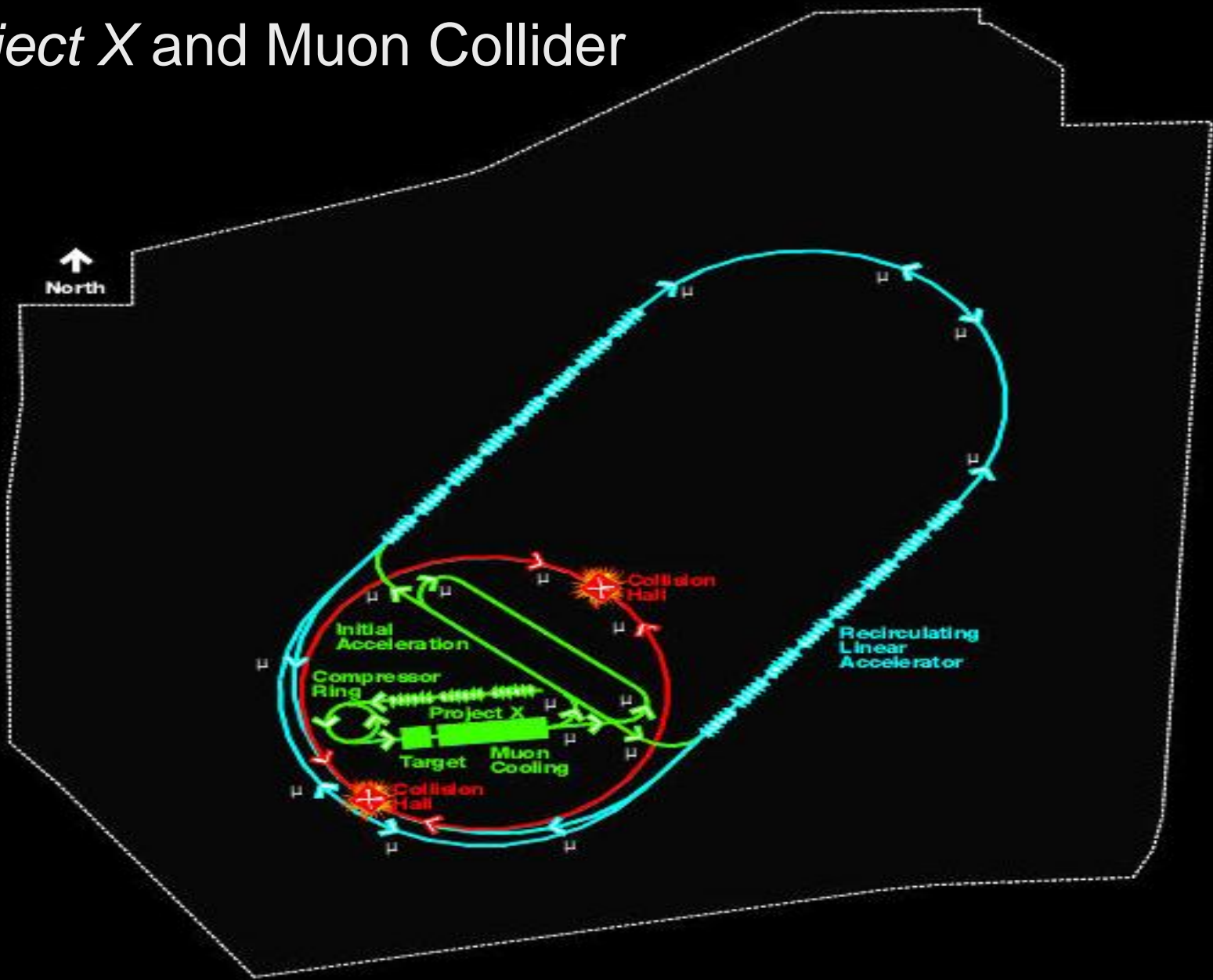


Yousry Gohar (Argonne)  
Shekhar Mishra (Fermilab)

## Energy Applications

- Transmutation experiments with nuclear waste
- Spallation target configurations
- Materials test under high irradiation
- Neutron fluxes under various configurations relevant to ADS

# *Project X and Muon Collider*



# CLIC and Muon Collider

## Signing Letter of Intent between Fermilab and CERN

Research on Multi-Megawatt Proton Facilities and **Energy Frontier Colliders**  
(SC RF technologies, SC magnet technologies, **multi-TeV lepton colliders**)



October , 2010

# Established Japan-US Collaboration on Intense Muon Sources

Supported by the Japan-US Program

# Closing remarks

- This workshop
  - will review the physics case for a Muon Collider, accelerator R&D progress, the outstanding challenges, future plans, and opportunities for new and existing groups to participate in the R&D.
- Planning
  - What are the next steps?
- Collaboration and Coordination
  - Physics and detector R&D (lepton colliders)
  - International Collaboration